Chapter 8.4
Welding, cutting, and brazing safely

This could be you . . .

A welder was welding on a pressure vessel suspended from a chain hoist when the hook on the hoist turned cherry-red hot. The welder had forgotten to ground his work piece. The arc welding system had found its own ground path through the vessel, through the hook on the hoist, through the building structure, and back to the welding machine. No one was injured, but the work was delayed for extra inspections because of the improper ground connection.

Two welders were welding on an overhead bridge crane when sparks fell approximately 40 feet into a titanium and magnesium scrap metal container below, causing a fire in the container. No one was hurt, but time was lost in the machine shop due to the evacuation of the building and the cleanup resulting from the fire.

1. Applicability of this chapter

You must follow this chapter if you do arc or heliarc welding, gas welding, gas cutting, or brazing.

2. General requirements for welding, cutting, or brazing

You must follow the general requirements given below:

a. Have a copy of the MSDS in your shop for every type of welding rod used.

b. Have a valid JSC Form 1475, "Hot Work-Welding-Cutting Permit," for all burning, cutting, or welding operations in all areas other than welding shops. See Chapter 5.8, "Hazardous operations: safe practices and certification," paragraph 12, of this handbook for more information. To create a permanent welding or hot work area, follow the procedure in Chapter 5.8, paragraphs 9–11.

c. Complete and get approvals on a JSC Form 992, "Confined Space Entry Procedure," and JSC Form 1476, "Confined Space Entry Permit," for all welding operations done in confined spaces. (See Chapter 6.10, "Entering confined spaces," of this handbook.)

d. Observe the requirements of Chapter 5.6, "Personal protective equipment," for fall protection and Chapter 8.7, "Ladders, scaffolds, and elevated platforms: how to work with them safely," of this handbook when working at heights of 4 feet or more above adjoining surfaces.

e. Keep welding cable and other equipment clear of all areas where others may be working.

f. Have helmets, shields, aprons, gloves, gauntlets, and other personal protective clothing required for each individual on the job.

g. Observe the requirements of Chapter 7.2, "Respiratory Protection," when welding activities could cause exposures to exceed established limits for metal fumes. Contact the Occupational Health Department for evaluation.

h. Never weld, cut, or braze painted surfaces. The paint may contain lead, chromium, or other hazardous compounds that will cause significant toxic exposures when heated or burned. You shall properly remove the paint before welding, cutting, or brazing. OSHA has regulations governing the proper removal of paint containing lead, chromium, and other metals. If you are not sure about the compounds in the painted surfaces, contact the Occupational Health Department, (281) 483-6726. They will analyze the paint and provide recommendations for the safe removal of the paint.

3. Fire precautions for welding, cutting, and brazing operations

You shall take the following fire precautions:

a. Observe the requirements of Chapter 5.1, "Fire safety," of this handbook.

b. Provide and maintain suitable fire extinguishing equipment for instant use.

c. Provide a properly trained fire watch for all welding or cutting operations where other than a minor fire may develop. A fire watch shall stay at the work site for at least 30 minutes after the hot-work operation. See Chapter 5.8, "Hazardous operations: safe practices and certification," paragraph 9, of this handbook for more information.

d. Before starting the job, remove, guard, or cover all materials or structures that might catch fire with a fire-resistive covering. This includes the bottled gas.

e. Where practicable, move all combustible materials at least 35 feet from the work site.

f. Take precautions to prevent sparks or slag from falling onto combustible material below through floor openings or cracks that can't be covered.

g. Don't weld, cut, or braze any unidentifiable material.

h. Have all areas and vessels that could have flammable or explosives materials present checked out by the Occupational Health Department.

i. Don't weld, cut, or braze near flammable or explosives materials.

4. When to use mechanical ventilation for welding

You shall have mechanical ventilation if you weld in a:

a. Room with less than 10,000 cubic feet per welder.

b. Room with ceilings less than 16 feet high.

c. Confined space.

d. Room in which it is recommended by Occupational Health Department to control exposures to welding fumes.

5. General requirements for welding, cutting, or brazing in a confined space

You shall follow the general requirements given below:

a. Observe the requirements of Chapter 6.10, "Entering confined spaces," of this handbook.

b. Leave the gas cylinders and welding machines outside the confined space.

c. Remove all welding electrodes and torch valves when you are not in the confined space.

d. Use local exhaust ventilation when needed to control exposures to welding fumes.

6. Local ventilation for welding on specific metals

You shall have adequate local ventilation, such as an exhaust hood or snorkel, if you weld or cut on the following materials:

a. Beryllium

b. Cadmium

c. Fluorides

d. Lead

e. Mercury

f. Stainless steel

g. Zinc

7. General requirements for gas welding

You shall:

a. Never use acetylene at pressures over 15 psi gauge pressure.

b. Use the special T-wrench to open the cylinder and leave it close to the cylinder for emergency use.

c. Handle the cylinders carefully.

d. Always use the cylinders in the upright position. Never store an acetylene cylinder on its side.

e. Have flashback protection on the cylinder.

f. Close and cap all cylinders not in use.

g. Avoid all oil and grease contact with oxygen cylinders, gauges, regulators, valves, and fittings. All of these items shall be rated and identified for oxygen use.

8. Caring for hoses

You shall properly care for your hoses by:

a. Protecting the hoses from damage.

b. Visually inspecting the hoses for leaks.

c. Repairing or replacing hoses that are damaged.

d. Using only standard ferrules or clamps on all hoses.

e. Not using tape or wire for holding hoses onto attachment points.

f. Regularly operating any relief valves to make sure that they work.

g. Never using bootleg adaptors that allow hoses to be used for non-specified connections.

9. Storing cylinders

You shall secure and store your cylinders in an upright position at all times during use, storage, and transportation. When not in use, store oxygen cylinders separately from fuel gas cylinders or combustible materials (especially oil and grease) by a minimum distance of 20 feet or by a ½-hour fire wall at least 5 feet high.

10. Requirements for arc welding

You shall observe the following:

a. Connect the ground return line securely.

b. Do not ground the welding generator. This supplies a second current path through building steel.

c. Protect auxiliary 240/120 volt outlets from the generator with a GFCI at the generator.

d. Ground the work piece properly.

e. Check connections before starting the welding machine.

f. Wear appropriate PPE as called out on the MSDS, by your supervisors and by the governing safety and health plan.

g. Make sure that your helper also wears appropriate PPE when working on or near welding, cutting, brazing, or grinding operations.

h. Use helmets, shields, and appropriate clothing to protect against flash burns, sparks, or flying particles.

i. Protect terminals for welding leads against accidental electrical contact by personnel or metal objects.

11. Certification required for welding at JSC

For the safety of all personnel, you shall be certified for the welding process, material, and hardware type you will be welding. Use the certification requirements in the following publications that are appropriate to what you are welding:

a. Flight Hardware – AMS-STD-1595, “Qualification of Aircraft, Missile, and Aerospace Fusion Welders”

b. Structural Hardware – AWS B2.1, “Standard for Weld Procedure and Performance Qualification”

c. Pressure Systems – American Society of Mechanical Engineers (ASME) Section IX, “Welding and Brazing Qualifications”

12. For more information on welding, cutting, and brazing

You can find more information on welding, cutting, and brazing in these documents:

a. 29 CFR 1910, Subpart Q, “Welding, Cutting, and Brazing”

b. NIOSH 75-115, “Engineering Controls for Welding Fumes”

c. NIOSH 78-138, “Safety and Health in Arc Welding and Gas Welding and Cutting”

d. NIOSH 77-131, “Welding Safety”

e. NIOSH 79-125, “Assessment of Selected Control Technology Techniques for Welding, Fumes”